



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<b>(54) Title:</b> ENDOSCOPIC BIOPSY FORCEPS DEVICE			
<b>(57) Abstract</b>			
<p>An endoscopic biopsy forceps (10) device incorporating a novel and unique camming arrangement for selectively opening and closing the biopsy cutting jaws (34, 36) of the biopsy forceps (10) which will render the entire device of a simpler construction and reliable in operation, while concurrently making it considerably less expensive to produce.</p>			

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ENDOSCOPIC BIOPSY FORCEPS DEVICE

The present invention relates to biopsy forceps and, more particularly, relates to an  
5 endoscopic biopsy forceps device incorporating a novel and unique camming arrangement for selectively opening and closing the biopsy cutting jaws of the biopsy forceps which will render the entire device of a simpler construction and  
10 reliable in operation, while concurrently making it considerably less expensive to produce.

Although varied types of biopsy forceps are currently in widespread use, such as in conjunction with endoscopic purposes, these are  
15 generally of complicated constructions necessitating the manufacture and assembly of numerous, highly precise components and, as a consequence, are quite expensive. Ordinarily, an endoscopic biopsy forceps device must be sterilized in strict  
20 compliance with rigid medical standards after each use thereof with a patient, so as to enable the device to again be safely employed with another patient for subsequent medical and/or surgical endoscopic biopsy procedures. Such sterilizing  
25 procedures entail immersing and rinsing the contaminated endoscopic biopsy forceps devices in a suitable chemical sterilizing solutions and/or subjecting the biopsy devices to sterilizing in an autoclave. The sterilizing of the biopsy devices  
30 with the utilization of chemical sterilizing solutions has, in more recent years, given rise to concerns that the contaminated biopsy devices were

1 not adequately sterilized for reuse with other  
patients, particularly in view of the considerable  
dangers to patients through exposure to poten-  
tially serious and even life-threatening infection  
5 with the AIDS virus (Acquired Immunity Deficiency  
Syndrome) or hepatitis B viruses, wherein  
sterilizing of the devices by means of such  
chemical solutions may not always be adequate to  
destroy the viruses, or at the very least, raise  
10 doubts as to the efficacy of the solutions.  
Furthermore, subjecting currently utilized  
endoscopic biopsy forceps devices to sterilizing  
procedures in an autoclave, under extremely  
rigorous physical conditions, frequently causes  
15 the rather delicate biopsy forceps devices to be  
destroyed, or damaged, and warped to such an  
extent as to render the devices unusable for  
repeated applications.

In order to overcome the limitations and  
20 drawbacks which are currently encountered in the  
technology, and in particular endoscopy, with  
respect to the constructions and employment of  
endoscopic biopsy forceps which will meet with the  
requirements of the medical profession, the  
25 present invention contemplates the provision of an  
endoscopic biopsy forceps device which, to an  
appreciable and highly desirably extent, reduces  
the large number of components in each such  
device; and in particular, affords for a  
30 considerable reduction in the necessary  
articulated elements, pivot points, rivets and  
attendant riveting operations in assembling the

1 forceps device. In view of the complex  
construction of such prior art biopsy forceps  
devices are extremely expensive, and because it  
may not always be possible to properly sterilize  
5 the device to provide adequate safeguards against  
infections for patients exposed to previously used  
devices, rendering discarding thereof uneconomic-  
cal, and possibly subjecting the medical facility  
and/or staff to legal liabilities in the event a  
10 patient is infected by a contaminated device.

Among the typical types of endoscopic  
biopsy forceps and similar types of devices which  
are currently known, the following are considered  
to be representative of the state-of-the  
15 technology.

Komiya, U.S. Patent 4,038,987 discloses  
a forceps device for an endoscope, wherein the  
operation of the cutting jaws of the forceps are  
effectuated through the intermediary of a toggle  
20 joint which is articulated by a control wire  
through the interposition of suitable linkage  
components. The toggle mechanism provided for in  
this patent necessitates the utilization of  
separate pivot pins for each jaw and provides for  
25 the type of operation in which the least amount of  
mechanical advantage is applied to the jaws during  
the closing of the forceps. This structure  
utilizes a multiplicity of linkage elements and  
pivots, rendering it highly susceptible to damage  
30 during sterilizing, while the device is extremely  
expensive because of the numerous components  
employed therein, necessitating the repeated use

1 thereof in order to cause the device to be  
economical.

Blake, III, U.S. Patent 4,662,374 discloses a ligator device in which a cam track is  
5 employed as a so-called "time delay" for the retraction of the clips proximate one of the clamping jaws. The operation of the camming arrangement utilized in Blake is completely unlike that of the camming arrangement utilized in the  
10 inventive endoscopic biopsy forceps and, moreover, necessitates the incorporation of an additional toggle mechanism in order to actuate the movement of the jaws. This particular device would not be employable as an endoscopic biopsy forceps.

15 Rich, U.S. Patent 4,752,185 employs a movable pin engaging a cam track in an operative mode as described hereinabove with respect to Blake, and necessitates the incorporation of a secondary pin as a pivot for the jaws of a  
20 surgical needle holder. This structure requires a more complex pin and cam track arrangement in comparison with the inventive endoscopic biopsy forceps device, and necessitates the utilization of auxiliary components which render the structure  
25 thereof expensive and inapplicable to a simple biopsy forceps device as is contemplated by the present invention.

Walter, et al., U.S. Patent 4,171,701 primarily pertains to a camping structure  
30 incorporated into a tweezer device, which requires the use of a secondary pin and linkage components in order to actuate the jaws of the device, and is

1 not at all suggestive of the simple, reliable and  
inexpensive camming arrangement employed in  
conjunction with the inventive endoscopic biopsy  
forceps device.

5       Further types of biopsy forceps and the  
like, all of which employ relatively complex pivot  
points, linkages and toggle mechanisms, are  
respectively disclosed in Komiya, U.S. Patent  
3,840,003; Hayashi, U.S. Patent 4,669,471;

10 Maslamka, U.S. Patent 4,646,751; and Schmidt, U.S.  
Patent 3,895,636. The constructions disclosed  
therein are primarily of the complex pivot pin and  
linkage systems, also employing toggle linkages  
and parallelogram linkages, which render the  
15 devices extremely complex, expensive and not at  
all adapted for single use or so-called throw-away  
operation as contemplated by the invention.

Accordingly, in order to eliminate or  
ameliorate the disadvantages and drawbacks  
20 encountered in prior art biopsy forceps,  
particularly those employed in endoscopy, the  
present invention relates to a unique and novel  
endoscopic biopsy forceps device inexpensively  
constituted from only a few and simple parts,  
25 wherein the usual types of linkages and number of  
pivot points required for the articulation of the  
forceps jaws have been extensively eliminated or  
reduced, and replaced by a simple camming  
arrangement in the form of cam tracks which,  
30 nevertheless, results in a highly reliable and  
simply operated endoscopic biopsy forceps device.  
This novel structure extensively reduces the

- 1 production costs of the foregoing forceps device  
to such an extent in comparison with the more  
complex prior art devices, such as to enable the  
device to be economically employed and discarded  
5 after only a single use; in essence, causing the  
device to become an inexpensive, disposable or so-  
called "throw-away" endoscopic biopsy forceps.  
This eliminates the necessity for having to  
subject the endoscopic biopsy forceps device to  
10 sterilizing in a chemical solution and/or an  
autoclave, and completely eliminates the danger of  
possible infection of a patient by a previously  
used and sterilized, but possibly still  
contaminated forceps device.
- 15 In order to achieve the foregoing  
object, the inventive endoscopic biopsy forceps  
device incorporates a novel camming arrangement  
comprising cooperating cam tracks formed in each  
of the shank portions of the cooperating forceps  
20 levers which cam tracks are displaceable along the  
surface a stationary guide or cam pin extending  
therethrough, and which is fastened to a housing  
attached to a flexible sheath which, in turn, is  
connected to an operating handle for the  
25 endoscope. The levers of the endoscopic biopsy  
forceps are articulated to a member which is  
slidable within a housing fastened to the end of  
the flexible sheath, the slidable member being  
reciprocated by a wire extending within the  
30 sheath, causing the cam tracks to move along the  
stationary pivot pin such as to in view of their  
curavatures or shapes, respectively, open or close

1 clamping jaws on the forceps levers. This  
construction reduces the number of pivot points  
encountered in prior art devices, and reduces the  
linkage components and pivots required by more  
5 than one-half in comparison with those of the  
currently known endoscopic biopsy forceps devices.

Pursuant to a preferred embodiment of  
the invention, the stationary pivot or pin along  
which the cam tracks are movable may be in the  
10 form of a screw extending through and fastened to  
the housing, thereby eliminating the necessity for  
welding and/or riveting of a pivot pin, and even  
further increasing the reliability and reducing  
the cost of the biopsy forceps device.

15 In accordance with a modification of the  
invention, the cam tracks may be of a linearly-  
angled slot configuration so as to impart the  
greatest clamping force to the jaws upon closing  
thereof.

20 The present invention relates to a  
biopsy forceps which is insertable through an  
endoscope into a body cavity for the separation of  
tissue therefrom; said forceps device comprising a  
flexible tubular sheath; a housing member secured  
25 to one end of said sheath and having a slot  
extending therethrough; a wire extending coaxially  
within said sheath for telescoping movement  
relative thereof; a movable member slidably  
supported in the slot of said housing member and  
30 being fastened to said wire; a pair of forceps  
levers each having a shank portion and an  
operating jaw extending from one end of said shank

1 portion; means at the opposite end of each said shank portion of each said lever for articulating said forceps levers to said movable member, a cam track consisting of a slot formed in the shank  
5 portion intermediate the ends thereof; and pivot means extending through said slot in each said lever shank portion and being fixedly connected to said housing member, whereby axial displacement of said movable member relative to said housing  
10 member responsive to axial movement of said wire in said sheath causes said slots to move in camming surface contact along said fixed pivot means and to pivot said forceps levers into respective opening and clamping movements of the  
15 clamping jaws on said forceps levers.

Reference may now be had to the following detailed description of exemplary embodiments of the invention showing preferred constructions for the inventive endoscopic biopsy  
20 forceps device; taken in conjunction with the accompanying drawings, in which:

Figure 1 illustrates, generally diagrammatically, a first embodiment of the operating end of an endoscopic biopsy forceps  
25 device which is constructed pursuant to the invention, the forceps jaws thereof being shown in an opened condition;

Figure 2 illustrates the device of Fig. 1 with the clamping jaws of the forceps shown in a  
30 closed position;

Figure 3 illustrates a sectional view through the device taken along line 3-3 in Fig. 2;

1 and,

Figure 4 illustrates a second embodiment  
of the endoscopic biopsy forceps device similar to  
Fig. 1 but with a modified cam track configura-  
5 tion.

Referring now in detail to Figs. 1 to 3,  
there is illustrated the inventive endoscopic  
biopsy forceps device 10 which includes a forceps  
sheath 12 constituted of a generally flexible or  
10 pliable material; for instance, teflon tubing or  
the like, which is connected a distal end thereof  
to a suitable operating mechanism (not shown) for  
actuating the forceps jaw structure of the biopsy  
forceps device.

15 Attached to the illustrated end of the  
sheath 23 is a suitable forceps lever support  
housing 14, which, if desired, may be constituted  
of stainless steel, and which includes a  
longitudinal central slot 16 fully extending  
20 between two opposite halves 18 and 19 of the  
housing 14. A slide member 20 is slidably  
supported for reciprocatory movement in the slot  
16 in coaxial relationship with the flexible  
sheath 12. The slide member 20 has one end  
25 thereof fastened to a flexible cable or wire 22  
which is telescopingly movable within the sheath  
12 in response to operation of the endoscope  
operating mechanism (not shown), as is well known  
in this technology.

30 A pair of cooperating forceps levers 24  
and 26 are articulated to the slide member 20  
through the intermediary of pivots 28 and 30, as

1 shown in more extensive detail in Figs. 2 and 3. The pivots may be integrally formed with or fastened to the slide member 20, whereby reciprocatory movement of the wire 22 within the 5 sheath 12 in response to actuation thereof will cause the pivots 28 and 30 to be rotated within bores 29, 31 in the shank portions of the forceps levers while being axially displaced within the slot 16 of housing 14 along with directions of 10 double-headed arrow A, depending upon whether the forceps devices is to be opened or closed. The articulation of the wire 22, which causes the displacement of pivots 28 and 30 along the directions of arrow A will cause the concurrent 15 displacement of the shank ends of the forceps levers 24 and 26 which are hinged to the sides member 20 at these pivots. The pivots 28, 30, if desired, may also be formed or rivets for fastening the forceps levers to the slide member.

20 The camming action which is imparted to the forceps levers 24 and 26 in response to the actuation or movement of wire 22 within the sheath 12 so as to selectively open or close forceps clamping jaws 34 and at the free ends of the 25 forceps levers distant from pivots 28, 30, is effectuated through the intermediary of novel camming arrangement provided for on the forceps levers 28, 30 incorporation with housing 14. This arrangement comprises cam tracks, in the form of 30 an elongate arcuate slot 38 formed in lever 24 and a similar oppositely curved slot 40 in other forceps lever 26, adapted to superimposed impart,

1 as shown in detail in Fig. 1 of the drawings. A  
fixed or stationary pivot pin 42, extends  
transversely through the cam track slots 38, 40,  
and is preferably in the shape of a screw which  
5 has the leading end of the screw portion thereof  
threadingly arranged in a completely threaded hole  
44 formed in one of the opposite halves 18 or 19  
of the housing 14, and with the head end of the  
screw being recessed in the opposite housing half  
10 so as to have the screw (or pivot pin) extend  
across the slot 16.

Fastened to the slide 20 so as to extend  
axially from the slot 16 between the clamping jaws  
34 and 36 on the forceps levers, is a suitable  
15 pointed spike element 46, for engaging tissue from  
a body cavity of a patient, which tissue is to be  
clamped off by the jaws of the forceps for  
purposes of biopsies, as is well-known in the art.

As may be ascertained from the  
20 foregoing, the axial displacement of the slide  
member 20 with the pivots 28, 30, and the  
resultant movement of the ends of forceps levers  
24, 26 which are hinged thereto, causes the cam  
track slots 38, 40 to move relative to the fixed  
25 pin or screw 42 extending therethrough.  
Consequently, as the wire 22 is retracted in the  
sheath 12, pulling the sliding member 20 and  
pivots 28, 30 away from the fixed screw or pin 42,  
the slots 38, 40 are biased together by the  
30 presence of the screw in their ends towards the  
forceps jaws, as shown in Fig. 2, and the forceps  
jaws pivoted towards each other into clamping

1 engagement. Conversely, the movement of slide member 20 in the opposite direction of arrow A, causes the slots 38, 40 to be moved along screw 42 into a position towards the lower ends of slots 5 38, 40 (as shown in Fig. 1), and pivots the forceps levers 24, 26 apart so as to open the forceps jaws 34, 36. In essence, all movement is effected relative to a single fixed and two displaceable pivot joints in the camming 10 arrangement, rather than through the numerous pivots of the prior art devices.

The embodiment illustrated in Fig. 4 of the drawings in which all components similar to or identical with those in Figs. 1 through 3 are 15 designated with the same reference numerals, is merely modified with regard to the previous embodiment, in that the cam track slots 50 and 52 each have two continuous linear portions 50' and 50'', and 52' and 52'' angled with regard to each 20 other in lieu of the curvilinear cam track configurations of the previous embodiment. The portions 50' and 52' of the cam track slots 50, 52 which are proximate the ends of the forceps jaws are angled so as to extend more acutely with or 25 closer to the axial centerline of the slide member 20 and forceps levers 24, 26 such that, upon closing of the forceps jaws, any further displacement of the wire 22 tending to continue 30 closing of the jaws will impart a greater biasing or clamping force to the cooperating jaws by the screw in the slots, thereby enhancing the clamping

1 action or mechanical advantage in gripping any tissue between the jaws.

From the foregoing, it becomes readily apparent to one skilled in the art that the novel 5 endoscopic biopsy forceps device is constituted of appreciably fewer and simpler parts than the devices which are currently being marketed, offering an enhanced degree of product reliability through the reduction of components; simplicity in 10 design, operation and manufacture, which renders the entire device much less expensive and highly economical in comparison with currently employed devices, so as to adapt it for use as a "throw-away" unit.

15 Due to the inventive camming arrangement, wherein the opening and closing movement of the forceps levers and of the forceps jaws are improved, the advantages offered by the inventive structure resides in:

20 (a) the cutting plane of the forceps jaws being closer to that of a straight line in comparison with the curvilinear movement employed by prior art devices, which results in an improved cutting action during the separation of the

25 desired specimen or tissue;

(b) during the closing of the forceps jaws, the specimen or tissue is prevented from slipping out of the cutting zone of the biopsy forceps;

30 (c) the production cost of the inventive endoscopic biopsy forceps device is considerably reduced due to the considerably fewer

1 employed components and articulated parts, thereby  
also increasing its operational reliability and  
stability;

5 (d) the area provided for engaging the  
jaws in cutting the specimen or tissue is  
considerably larger than for conventional forceps;

10 (e) basically all rivets and linkages  
encountered in prior art forceps of this type have  
been eliminated, which simplifies the overall  
assembly and also reduces the necessary assembling  
time for the forceps device;

15 (f) the resultant shorter operating  
stroke provided for by the camming arrangement  
increases the radius of operation of the device  
and imparts better control and feel of the device  
to nurses, physicians or medical technicians  
handling the forceps;

20 (g) elimination of any danger to a  
patient caused by an infection through the  
subsequent use of a biopsy forceps device which  
may still be contaminated, in that the reduction  
in the cost thereof renders the device disposable  
as a "throw-away" after a single use, while  
nevertheless still being appreciably more  
25 cost-effective in contrast with currently utilized  
biopsy forceps devices.

While there has been shown and described  
what is considered to be preferred embodiments of  
the invention, it will, of course, be understood  
30 that various modifications and changes in form or  
detail could readily be made without departing  
from the spirit of the invention. It is therefore

I intended that the invention not be limited to the exact form than the whole of the invention herein disclosed as hereinafter claimed.

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**SUBSTITUTE SHEET**

1 WHAT IS CLAIMED IS:

1. A biopsy forceps device which is insertable through an endoscope into a body cavity for the separation of tissue therefrom; said
- 5 forceps device comprising a flexible tubular sheath; a housing member secured to one end of said sheath and having a slot extending therethrough; a wire extending coaxially within said sheath for telescoping movement relative thereof;
- 10 a movable member slidably supported in the slot of said housing member and being fastened to said wire; a pair of forceps levers each having a shank portion and an operating jaw extending from one end of said shank portion; means at the opposite
- 15 end of each said shank portion of each said lever for articulating said forceps levers to said movable member, a cam track consisting of a slot formed in the shank portion intermediate the ends thereof; and pivot means extending through said
- 20 slot in each said slot in each said lever shank portion and being fixedly connected to said housing member, whereby axial displacement of said movable member relative to said housing member responsive to axial movement of said wire in said
- 25 sheath causes said slots to move in camming surface contact along said fixed pivot means and to pivot said forceps levers into respective opening and clamping movements of the clamping jaws on said forceps levers.
- 30 2. A forceps device as claimed in Claim 1, wherein said pivot means extending through said cam slots in said forceps levers comprises a screw

1 member extending across the slot in said housing member and includes a threaded screw portion engaged in a threaded bore in said housing member.

3. A forceps device as claimed in Claim 5 1, wherein said forceps levers are articulated to said link member by pivots on said movable member pivotally engaging into bores in the shank portions of said levers.

4. A forceps device as claimed in Claim 10 3, wherein said pivots are integrally formed with said movable member.

5. A forceps device as claimed in Claim 1, wherein said cam slots comprise elongate arcuate slots extending in oppositely curved 15 orientations in each of said forceps levers.

6. A forceps device as claimed in Claim 1, wherein said cam slots comprise elongate slots having first and second linear elongate slot portions angled relative to each other and 20 extending in oppositely sloped orientations in each of said forceps levers for effectuating the respective opening and closing camming movements of said forceps jaws.

7. A forceps device as claimed in Claim 25 6, wherein the portion of each of said linear slots proximate the jaws extends at a narrow angle relative to the longitudinal axis of the forceps levers so as to increase the clamping action between said forceps jaws subsequent to the 30 closing of said forceps.

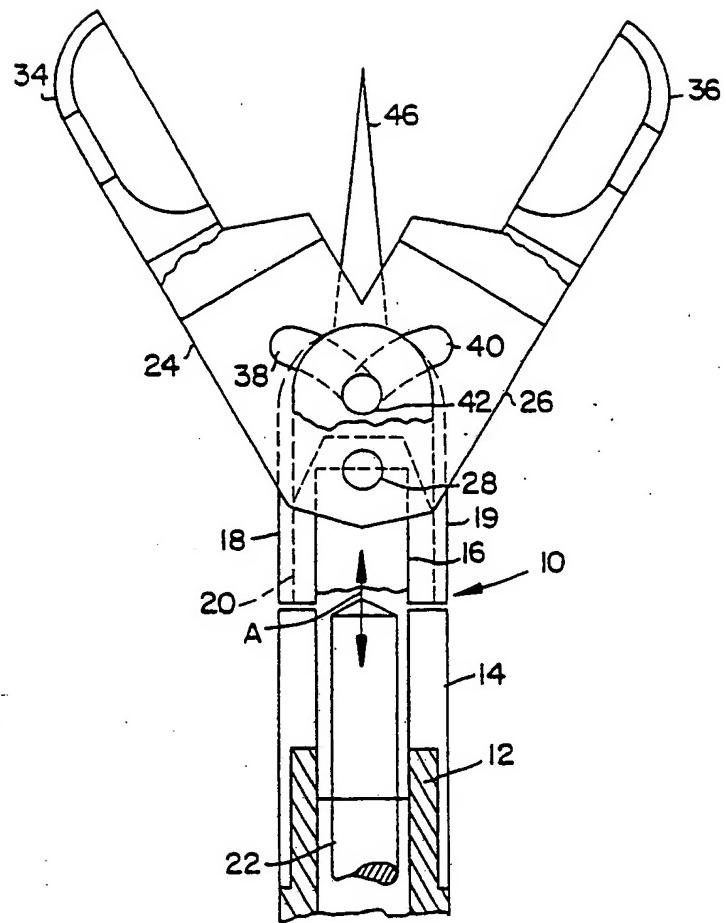


FIG. 1

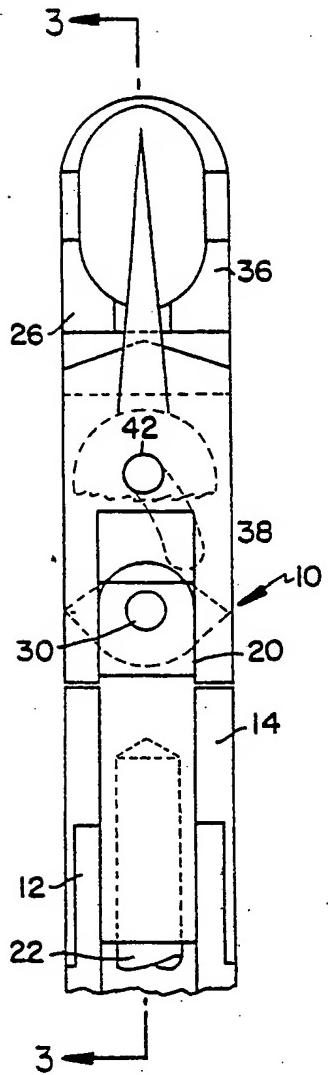


FIG. 2

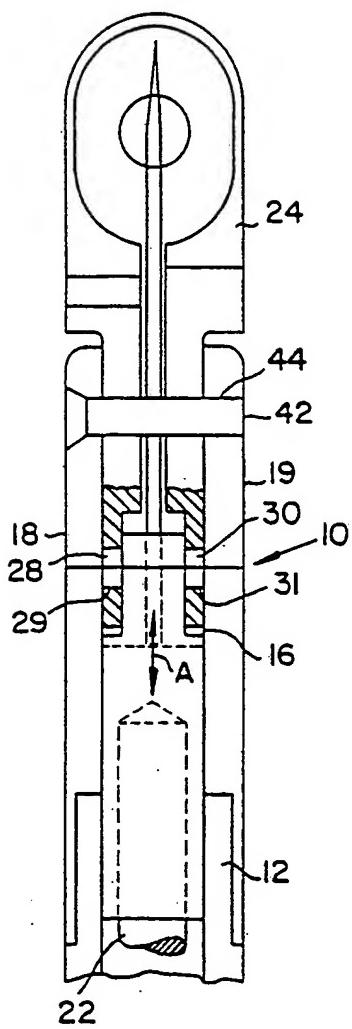


FIG. 3

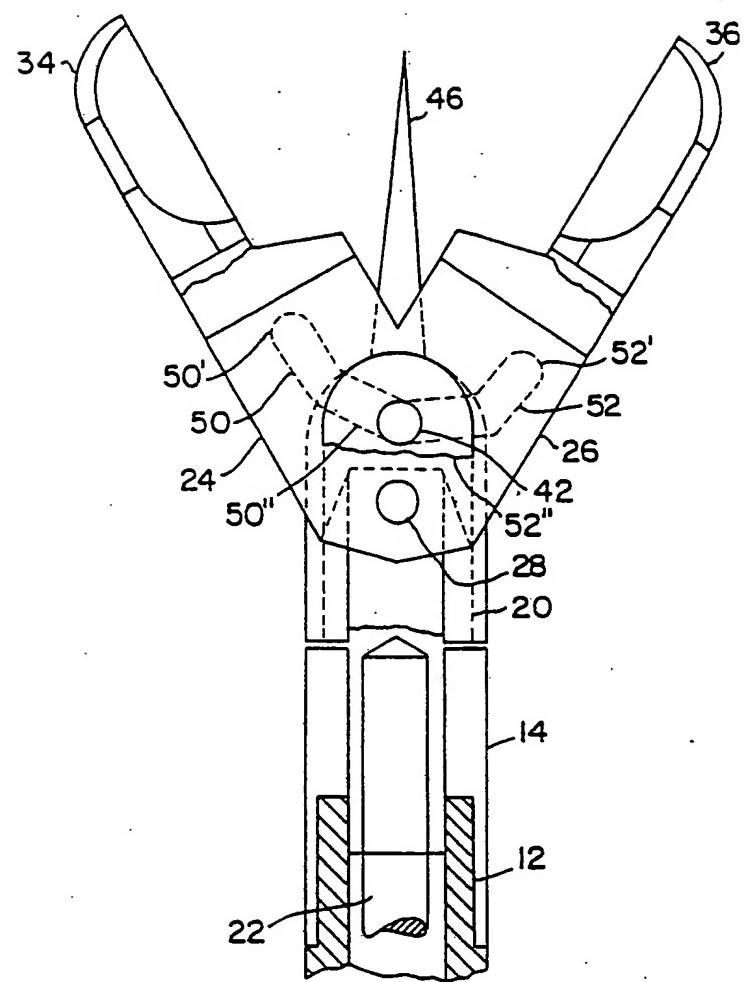


FIG. 4

**I. CLASSIFICATION OF SUBJECT MATTER** (if several classification symbols apply, indicate all) <sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4) A61B 10/00

US CL. 128/751

**II. FIELDS SEARCHED**Minimum Documentation Searched <sup>7</sup>

Classification System	Classification Symbols
US	128/4-10,303R,303.1,321,345,749,751 604/22 294/115,116 81/128

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>**III. DOCUMENTS CONSIDERED TO BE RELEVANT** <sup>9</sup>

Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	US,A, 3,895,636 (SCHMIDT) 22 July 1975 See entire document.	1-7
A	US,A, 4,151,763 (COLVIN) 01 May 1979 See figure 2; lines 60-69, column 4.	1-7
A	US,A, 4,662,374 (BLAKE, III) 05 May 1987 See figure 4; lines 28-49, column 2.	1-7

\* Special categories of cited documents: <sup>10</sup>

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&amp;" document member of the same patent family

**IV. CERTIFICATION**

Date of the Actual Completion of the International Search

09 June 1989

Date of Mailing of this International Search Report

17 JUL 1989

International Searching Authority

Signature of Authorized Officer

ISA/US

  
William Lewis

## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 :  A61B 10/00		A1	(11) International Publication Number: WO 89/10093  (43) International Publication Date: 2 November 1989 (02.11.89)
<p>(21) International Application Number: PCT/US89/01776</p> <p>(22) International Filing Date: 27 April 1989 (27.04.89)</p> <p>(30) Priority data: 186,564 27 April 1988 (27.04.88) US</p> <p>(71) Applicant: ESCO PRECISION, INC. [US/US]; 21 William Penn Drive, Stony Brook, NY 11790 (US).</p> <p>(72) Inventors: ESSER, Theodor ; 21 William Penn Drive, Stony Brook, NY 11790 (US). DOHERTY, Thomas, Edward ; 7 Carriage Lane, Setauket, NY 11733 (US).</p> <p>(74) Agent: SCOTT, Anthony, C.; Scully, Scott, Murphy &amp; Presser, 400 Garden City Plaza, Garden City, NY 11530 (US).</p>		<p>(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).</p> <p><b>Published</b> <i>With international search report.</i></p>	
<p><b>(54) Title:</b> ENDOSCOPIC BIOPSY FORCEPS DEVICE</p> <p><b>(57) Abstract</b></p> <p>An endoscopic biopsy forceps (10) device incorporating a novel and unique camming arrangement for selectively opening and closing the biopsy cutting jaws (34, 36) of the biopsy forceps (10) which will render the entire device of a simpler construction and reliable in operation, while concurrently making it considerably less expensive to produce.</p>			

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ENDOSCOPIC BIOPSY FORCEPS DEVICE

The present invention relates to biopsy forceps  
5 and, more particularly, relates to an endoscopic biopsy  
forceps device incorporating a novel and unique camming  
arrangement for selectively opening and closing the biopsy  
cutting jaws of the biopsy forceps which will render the  
entire device of a simpler construction and reliable in  
10 operation, while concurrently marking it considerably less  
expensive to produce.

Although varied types of biopsy forceps are  
currently in widespread use, such as in conjunction with  
endoscopic purposes, these are generally of complicated  
15 constructions necessitating the manufacture and assembly of  
numerous, highly precise components and, as a consequence,  
are quite expensive. Ordinarily, an endoscopic biopsy  
forceps device must be sterilized in strict compliance with  
rigid medical standards after each use thereof with a  
20 patient, so as to enable the device to again be safely  
employed with another patient for subsequent medical and/or  
surgical endoscopic biopsy procedures. Such sterilizing  
procedures entail immersing and rinsing the contaminated  
endoscopic biopsy forceps devices in a suitable chemical  
25 sterilizing solutions and/or subjecting the biopsy devices  
to sterilizing in an autoclave. The sterilizing of the  
biopsy devices with the utilization of chemical sterilizing  
solutions has, in more recent years, given rise to concerns  
that the contaminated biopsy devices were not adequately  
30 sterilized for reuse with other patients, particularly in  
view of the considerable dangers to patients through  
exposure to potentially serious and even life-threatening

1 infection with the AIDS virus (Acquired Immunity Deficiency  
Syndrome) or hepatitis B viruses, wherein sterilizing of the  
devices by means of such chemical solutions may not always  
be adequate to destroy the viruses, or at the very least,  
5 raise doubts as to the efficacy of the solutions.  
5 Furthermore, subjecting currently utilized endoscopic biopsy  
forceps devices to sterilizing procedures in an autoclave,  
under extremely rigorous physical conditions, frequently  
causes the rather delicate biopsy forceps devices to be  
10 destroyed, or damaged and warped to such an extent as to  
render the devices unusable for repeated applications.

In order to overcome the limitations and drawbacks  
which are currently encountered in the technology, and  
particular in endoscopy, with respect to the constructions  
and employment of endoscopic biopsy forceps which will meet  
15 with the requirements of the medical profession, the present  
invention contemplates the provision of an endoscopic biopsy  
forceps device which, to an appreciable and highly desirably  
extent, reduces the large number of components in each such  
device; and in particular, affords for a considerable  
20 reduction in the necessary articulated elements, pivot  
points, rivets and attendant riveting operations in  
assembling the forceps device. In view of the complex  
construction of such prior art biopsy forceps devices are  
extremely expensive, and because it may not always be  
25 possible to properly sterilize the device to provide  
adequate safeguards against infections for patients exposed  
to previously used devices, rendering discarding thereof  
uneconomical, and possibly subjecting the medical facility  
and/or staff to legal liabilities in the event a patient is  
30 infected by a contaminated device.

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Among the typical types of endoscopic biopsy forceps and similar types of devices which are currently known, the following are considered to be representative of the state-of-the-technology.

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Komiya U. S. Patent 4,038,987 discloses a forceps device for an endoscope, wherein the operation of the cutting jaws of the forceps are effectuated through the intermediary of a toggle joint which is articulated by a control wire through the interposition of suitable linkage components. The toggle mechanism provided for in this patent necessitates the utilization of separate pivot pins for each forceps jaw and provides for the type of operation in which the least amount of mechanical advantage is applied to the jaws during the closing of the forceps. This structure utilizes a multiplicity of linkage elements and pivots, rendering it highly susceptible to damage during sterilizing, while the device is extremely expensive because of the numerous components employed therein, necessitating the repeated use thereof in order to cause the device to be economical.

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Blake, III, U. S. Patent 4,662,374 discloses a ligator device in which a cam track is employed as a so-called "time delay" for the retraction of the clips proximate one of the clamping jaws. The operation of the camming arrangement utilized in Blake is completely unlike that of the camming arrangement utilized in the inventive endoscopic biopsy forceps and, moreover, necessitates the incorporation of an additional toggle mechanism in order to actuate the movement of the jaws. This particular device would not be employable as an endoscopic biopsy forceps.

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1 Rich U. S. Patent 4,572,185 employs a movable pin  
engaging a cam track in an operative mode as described  
hereinabove with respect to Blake, and necessitates the  
incorporation of a secondary pin as a pivot for the jaws of  
5 a surgical needle holder. This structure requires a more  
complex pin and cam track arrangement in comparison with the  
inventive endoscopic biopsy forceps device, and necessitates  
the utilization of auxiliary components which render the  
structure thereof expensive and inapplicable to a simple  
10 biopsy forceps device as is contemplated by the present  
invention.

Walter, et al. U. S. Patent 4,171,701 primarily  
pertains to a camming structure incorporated into a tweezers  
device, which requires the use of secondary pin and linkage  
15 components in order to actuate the jaws of the device, and  
is not at all suggestive of the simple, reliable and  
inexpensive camming arrangement employed in conjunction with  
the inventive endoscopic biopsy forceps device.

Further types of biopsy forceps and the like, all  
of which employ relatively complex pivot points, linkages  
20 and toggle mechanisms, are respectively disclosed in Komiya  
U. S. Patent 3,840,003; Hayashi U. S. Patent 4,669,471;  
Maslamka U. S. Patent 4,646,751; and Schmidt U. S. Patent  
3,895,636. The constructions disclosed therein are  
primarily of the complex pivot pin and linkage systems, also  
25 employing toggle linkages and parallelogram linkages,  
which render the devices extremely complex, expensive and  
not at all adapted for single use or so-called throw-away  
operation as contemplated by the invention.

30 Accordingly, in order to eliminate or ameliorate  
the disadvantages and drawbacks encountered in prior art

1 biopsy forceps, particularly those employed in endoscopy, the  
present invention relates to a unique and novel endoscopic  
biopsy forceps device inexpensively constituted from only a  
few and simple parts, wherein the usual types of linkages  
5 and number of pivot points required for the articulation of  
the forceps jaws have been extensively eliminated or  
reduced, and replaced by a simple camming arrangement in the  
form of cam tracks which, nevertheless, results in a highly  
reliable and simply operated endoscopic biopsy forceps  
device. This novel structure extensively reduces the  
10 production costs of the forceps device to such an extent in  
comparison with the more complex prior art devices, such as  
to enable the device to be economically employed and  
discarded after only a single use; in essence, causing the  
device to become an inexpensive, disposable or so-called  
15 "throw-away" endoscopic biopsy forceps. This eliminates the  
necessity for having to subject the endoscopic biopsy  
forceps device to sterilizing in a chemical solution and/or  
an autoclave, and completely eliminates the danger of  
possible infection of a patient by a previously used and  
20 sterilized, but possibly still contaminated forceps device.

In order to achieve the foregoing object, the  
inventive endoscopic biopsy forceps device incorporates a  
novel camming arrangement comprising cooperating cam tracks  
25 formed in each of the shank portions of the cooperating  
forceps levers which cam tracks are displaceable along the  
surface a stationary guide or cam pin extending  
therethrough, and which is fastened to a housing attached to  
a flexible sheath which, in turn, is connected to an  
operating handle for the endoscope. The levers of the  
30 endoscopic biopsy forceps are articulated to a member which  
is slidably within a housing fastened to the end of the

1 flexible sheath, the slideable member being reciprocated by a  
wire extending within the sheath, causing the cam tracks to  
move along the stationary pivot pin such as to in view of  
their curvatures or shapes, respectively, open or close  
5 clamping jaws on the forceps levers. This construction  
reduces the number of pivot points encountered in prior art  
devices, and reduces the linkage components and pivots  
required by more than one-half in comparison with those of  
the currently known endoscopic biopsy forceps devices.

10 Pursuant to a preferred embodiment of the  
invention, the stationary pivot or pin along which the cam  
tracks are movable may be in the form of a screw extending  
through and fastened to the housing, thereby eliminating the  
necessity for welding and/or riveting of a pivot pin, and  
even further increasing the reliability and reducing the  
15 cost of the biopsy forceps device.

20 In accordance with a modification of the  
invention, the cam tracks may be of a linearly-angled slot  
configuration so as to impart the greatest clamping force to  
the jaws upon closing thereof.

25 The present invention relates to a biopsy forceps  
which is insertable through an endoscope into a body cavity for  
the separation of tissue therefrom; said forceps device comprising  
a flexible tubular sheath; a housing member secured to one end  
of said sheath and having a slot extending therethrough; a  
30 wire extending coaxially within said sheath for telescoping  
movement relative thereof; a movable member slidably  
supported in the slot of said housing member and being  
fastened to said wire; a pair of forceps levers each having  
35 a shank portion and an operating jaw extending from one end  
of said shank portion; means at the opposite end of each  
said shank portion of each said lever for articulating said  
forceps levers to said movable member, a cam track  
40 consisting of a slot formed in the shank portion  
intermediate the ends thereof; and pivot means extending

1 through said slot in each said lever shank portion and being  
fixedly connected to said housing member, whereby axial  
displacement of said movable member relative to said housing  
member responsive to axial movement of said wire in said  
5 sheath causes said slots to move in camming surface contact  
along said fixed pivot means and to pivot said forceps levers  
into respective opening and clamping movements of the  
clamping jaws on said forceps levers.

Reference may now be had to the following detailed  
10 description of exemplary embodiments of the invention  
showing preferred constructions for the inventive endoscopic  
biopsy forceps device; taken in conjunction with the  
accompanying drawings; in which:

Figure 1 illustrates, generally diagrammatically,  
15 a first embodiment of the operating end of an endoscopic  
biopsy forceps device which is constructed pursuant to the  
invention, the forceps jaws thereof being shown in an opened  
condition;

Figure 2 illustrates the device of Fig. 1 with the  
20 clamping jaws of the forceps shown in a closed position;

Figure 3 illustrates a sectional view through the  
device taken along line 3 - 3 in Fig. 2; and

Figure 4 illustrates a second embodiment of the  
endoscopic biopsy forceps device similar to Fig. 1 but with a  
25 modified cam track configuration.

Referring now in detail to Figs. 1 to 3, there is  
illustrated the inventive endoscopic biopsy forceps device  
10 which includes a forceps sheath 12 constituted of a  
generally flexible or pliable material; for instance, teflon  
30 tubing or the like, which is connected at a distal end  
thereof to a suitable operating mechanism (not shown) for  
actuating the forceps jaw structure of the biopsy forceps  
device.

Attached to the illustrated end of the sheath 12  
35 is a suitable forceps lever support housing 14, which, if

1 desired, may be constituted of stainless steel, and which  
includes a longitudinal central slot 16 fully extending  
between two opposite halves 18 and 19 of the housing 14. A  
slide member 20 is slidably supported for reciprocatory  
5 movement in the slot 16 in coaxial relationship with the  
flexible sheath 12. The slide member 20 has one end thereof  
fastened to a flexible cable or wire 22 which is  
telescopingly movable within the sheath 12 in response to  
operation of the endoscope operating mechanism (not shown),  
10 as is well known in this technology.

A pair of cooperating forceps levers 24 and 26 are  
articulated to the slide member 20 through the intermediary  
of pivots 28 and 30, as shown in more extensive detail in  
15 Figs. 2 and 3. The pivots may be integrally formed with or  
fastened to the slide member 20, whereby reciprocatory  
movement of the wire 22 within the sheath 12 in response to  
actuation thereof will cause the pivots 28 and 30 to be  
rotated within bores 29, 31 in the shank portions of the  
forceps levers while being axially displaced within the slot  
20 16 of housing 14 along the directions of double-headed arrow  
A, depending upon whether the forceps devices is to be  
opened or closed. The articulation of the wire 22, which  
causes the displacement of pivots 28 and 30 along the  
directions of arrow A will cause the concurrent displacement  
25 of the shank ends of the forceps levers 24 and 26 which are  
hinged to the sides member 20 at these pivots. The pivots  
28, 30, if desired, may also be formed or rivets for  
fastening the forceps levers to the slide member.

The camming action which is imparted to the  
30 forceps levers 24 and 26 in response to the actuation or  
movement of wire 22 within the sheath 12 so as to selectively  
open or close forceps clamping jaws 34 and 36 at the free

1 ends of the forceps levers distant from pivots 28, 30, is  
effectuated through the intermediary of a novel camming  
arrangement provided for on the forceps levers 28, 30  
incorporation with housing 14. This arrangement comprises  
5 cam tracks, in the form of an elongate arcuate slot 38  
formed in lever 24 and a similar oppositely curved slot 40 in  
the other forceps lever 26, adapted to superimposed impart,  
as shown in detail in Fig. 1 of the drawings. A fixed or  
stationary pivot pin 42, extends transversely through the cam  
track slots 38, 40, and is preferably in the shape of a  
10 screw which has the leading end of the screw portion thereof  
threadingly arranged in a completely threaded hole 44 formed  
in one of the opposite halves 18 or 19 of the housing 14,  
and with the head end of the screw being recessed in the  
opposite housing half so as to have the screw (or pivot pin)  
15 extend across the slot 16.

Fastened to the slide 20 so as to extend axially  
from the slot 16 between the clamping jaws 34 and 36 on the  
forceps levers, is a suitable pointed spike element 46,  
20 for engaging tissue from a body cavity of a patient, which  
tissue is to be clamped off by the jaws of the forceps for  
purposes of biopsies, as is well-known in the art.

As may be ascertained from the foregoing, the  
axial displacement of the slide member 20 with the pivots  
28, 30, and the resultant movement of the ends of forceps  
25 levers 24, 26 which are hinged thereto, causes the cam track  
slots 38, 40 to move relative to the fixed pin or screw 42  
extending therethrough. Consequently, as the wire 22 is  
retracted in the sheath 12, pulling the sliding member 20  
30 and pivots 28, 30 away from the fixed screw or pin 42, the  
slots 38, 40 are biased together by the presence of the  
screw in their ends towards the forceps jaws, as shown in

1 Fig. 2, and the forceps jaws pivoted towards each other into  
clamping engagement. Conversely, the movement of slide  
member 20 in the opposite direction of arrow A, causes the  
slots 38, 40 to be moved along screw 42 into a position  
5 towards the lower ends of slots 38, 40 (as shown in Fig. 1),  
and pivots the forceps levers 24, 26 apart so as to open the  
forceps jaws 34, 36. In essence, all movement is effected  
relative to a single fixed and two displaceable pivot joints  
in the camming arrangement, rather than through the numerous  
10 pivots of the prior art devices.

The embodiment illustrated in Fig. 4 of the drawings in which all components similar to or identical with those in Figs. 1 through 3 are designated with the same reference numerals, is merely modified with regard to the previous embodiment, in that the cam track slots 50 and 52 each have two continuous linear portions 50' and 50'', and 52' and 52'' angled with regard to each other in lieu of the curvilinear cam track configurations of the previous embodiment. The portions 50' and 52' of the cam track slots 50, 52 which are proximate the ends of the forceps jaws are angled so as to extend more acutely with or closer to the axial centerline of the slide member 20 and forceps levers 24, 26 such that, upon closing of the forceps jaws, any further displacement of the wire 22 tending to continue closing of the jaws will impart a greater biasing or clamping force to the cooperating jaws by the screw in the slots, thereby enhancing the clamping action or mechanical advantage in gripping any tissue between the jaws.

From the foregoing, it becomes readily apparent to one skilled in the art that the novel endoscopic biopsy forceps device is constituted of appreciably fewer and simpler parts than the devices which are currently being

1 marketed, offering an enhanced degree of product reliability  
through the reduction of components, simplicity in design,  
operation and manufacture, which renders the entire device  
much less expensive and highly economical in comparison with  
5 currently employed devices, so as to adapt it for use as a  
"throw-away" unit.

10 Due to the inventive camming arrangement, wherein  
the opening and closing movement of the forceps levers and of  
the forceps jaws are improved, the advantages offered by the  
inventive structure resides in:

15 (a) the cutting plane of the forceps jaws being  
closer to that of a straight line in comparison with the  
curvilinear movement employed by prior art devices, which  
results in an improved cutting action during the separation  
of the desired specimen or tissue;

20 (b) during the closing of the forceps jaws, the  
specimen or tissue is prevented from slipping out of the  
cutting zone of the biopsy forceps;

25 (c) the production cost of the inventive  
endoscopic biopsy forceps device is considerably reduced due  
to the considerably fewer employed components and  
articulated parts, thereby also increasing its operational  
reliability and stability;

30 (d) the area provided for engaging the jaws in  
cutting the specimen or tissue is considerably larger than  
for conventional forceps;

(e) basically all rivets and linkages encountered  
in prior art forceps of this type have been eliminated,  
which simplifies the overall assembly and also reduces the  
necessary assembling time for the forceps device.

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1                         (f) the resultant shorter operating stroke  
provided for by the camming arrangement increases the radius  
of operation of the device and imparts better control and  
feel of the device to nurses, physicians or medical  
technicians handling the forceps;  
5

10                         (g) elimination of any danger to a patient caused  
by an infection through the subsequent use of a biopsy  
forceps device which may still be contaminated, in that the  
reduction in the cost thereof renders the device disposable  
as a "throw-away" after a single use, while nevertheless  
still being appreciably more cost-effective in contrast with  
currently utilized biopsy forceps devices.

15                         While there has been shown and described what is  
considered to be preferred embodiments of the invention, it  
will, of course, be understood that various modifications and  
changes in form or detail could readily be made without  
departing from the spirit of the invention. It is therefore  
intended that the invention be not limited to the exact form  
than the whole of the invention herein disclosed as  
hereinafter claimed.  
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1      WHAT IS CLAIMED IS:

1      1. A biopsy forceps device which is insertable  
through an endoscope into a body cavity for the separation  
of tissue therefrom; said forceps device comprising a  
5      flexible tubular sheath; a housing member secured to one end  
of said sheath and having a slot extending therethrough; a  
wire extending coaxially within said sheath for telescoping  
movement relative thereof; a movable member slidably  
10     supported in the slot of said housing member and being  
fastened to said wire; a pair of forceps levers each having  
a shank portion and an operating jaw extending from one end  
of said shank portion; means at the opposite end of each  
said shank portion of each said lever for articulating said  
forceps levers to said movable member, a cam track  
15     consisting of a slot formed in the shank portion  
intermediate the ends thereof; and pivot means extending  
through said slot in each said lever shank portion and being  
fixedly connected to said housing member, whereby axial  
displacement of said movable member relative to said housing  
member responsive to axial movement of said wire in said  
20     sheath causes said slots to move in camming surface contact  
along said fixed pivot means and to pivot said forceps levers  
into respective opening and clamping movements of the  
clamping jaws on said forceps levers.

25     2. A forceps device as claimed in Claim 1,  
wherein said pivot means extending through said cam slots in  
said forceps levers comprises a screw member extending  
across the slot in said housing member and includes a  
threaded screw portion engaged in a threaded bore in said  
housing member.

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1       3. A forceps device as claimed in Claim 1,  
wherein said forceps levers are articulated to said link  
member by pivots on said movable member pivotally engaging  
into bores in the shank portions of said levers.

5       4. A forceps device as claimed in Claim 3, wherein  
said pivots are integrally formed with said movable member.

10      5. A forceps device as claimed in Claim 1, wherein  
said cam slots comprise elongate arcuate slots extending in  
oppositely curved orientations in each of said forceps  
levers.

15      6. A forceps device as claimed in Claim 1,  
wherein said cam slots comprise elongate slots having first  
and second linear elongate slot portions angled relative to  
each other and extending in oppositely sloped orientations  
in each of said forceps levers for effectuating the  
respective opening and closing camming movements of said  
forceps jaws.

20      7. A forceps device as claimed in Claim 6,  
wherein the portion of each of said linear slots proximate  
the jaws extends at a narrow angle relative to the  
longitudinal axis of the forceps levers so as to increase  
the clamping action between said forceps jaws subsequent to  
this closing of said forceps.

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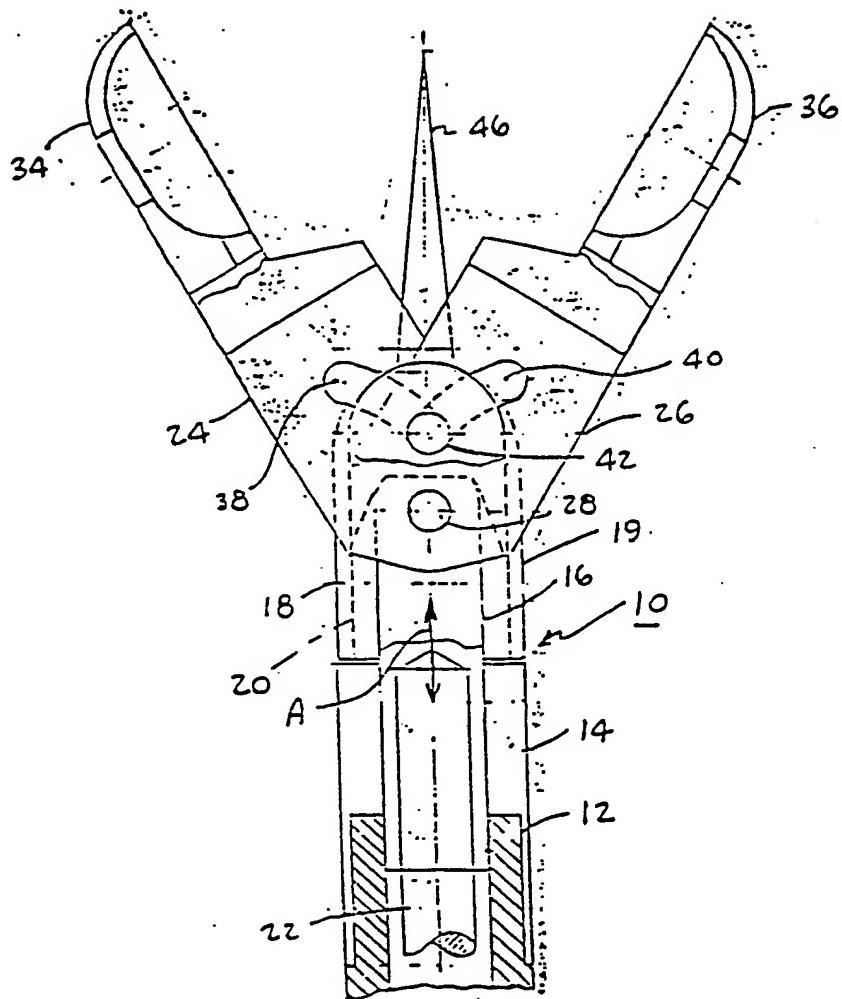


FIG. 1

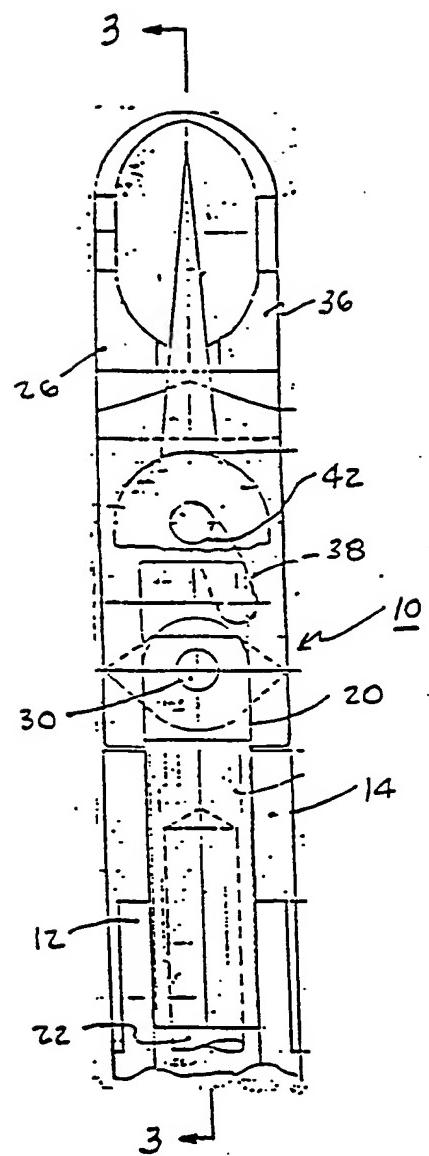


FIG. 2

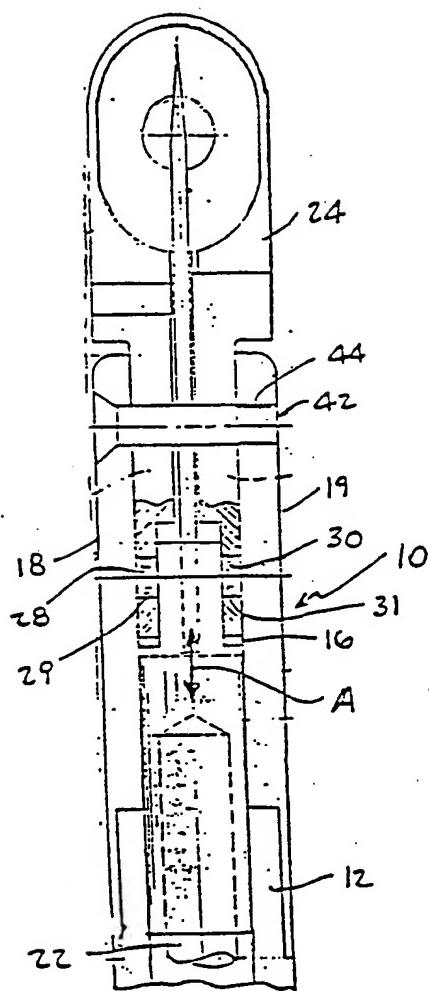


FIG. 3

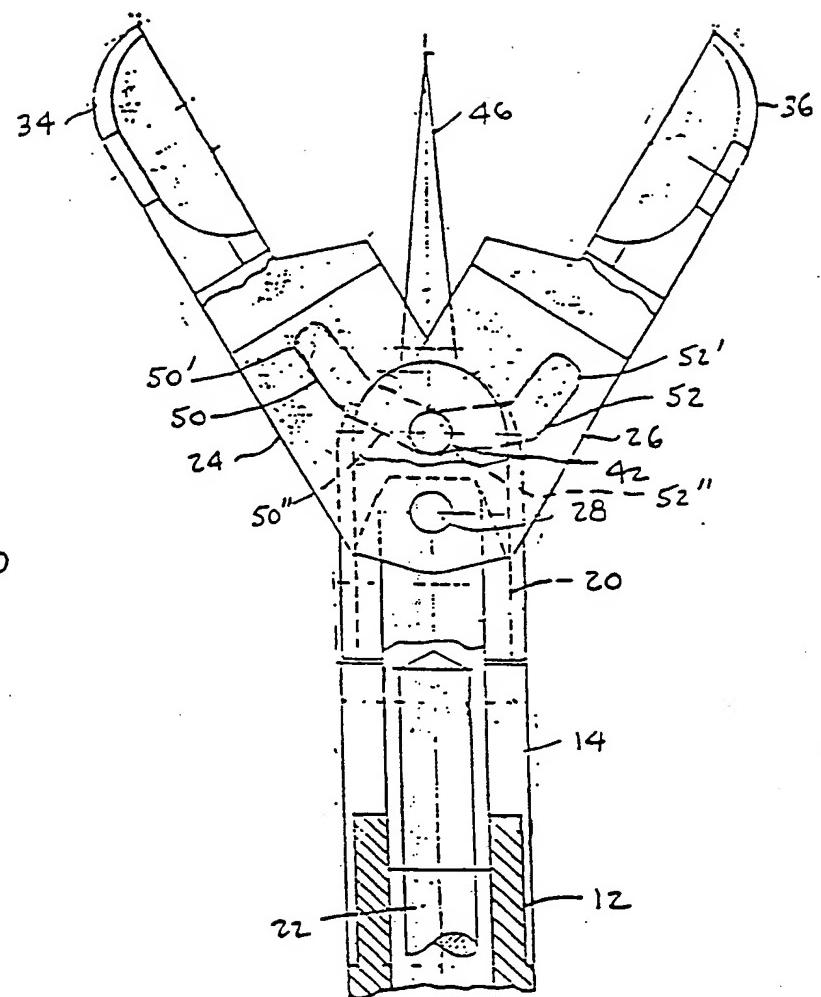


FIG. 4

**I. CLASSIFICATION OF SUBJECT MATTER** (if several classification symbols apply, indicate all) <sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4) A61B 10/00

US Cl. 128/751

**II. FIELDS SEARCHED**Minimum Documentation Searched <sup>7</sup>

Classification System	Classification Symbols
US	128/4-10,303R,303.1,321,345,749,751 604/22 294/115,116 81/128

Documentation Searched other than Minimum Documentation  
to the Extent that such Documents are Included in the Fields Searched <sup>8</sup>**III. DOCUMENTS CONSIDERED TO BE RELEVANT** <sup>9</sup>

Category <sup>10</sup>	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
Y	US,A, 3,895,636 (SCHMIDT) 22 July 1975 See entire document.	1-7
A	US,A, 4,151,763 (COLVIN) 01 May 1979 See figure 2; lines 60-69, column 4.	1-7
A	US,A, 4,662,374 (BLAKE, III) 05 May 1987 See figure 4; lines 28-49, column 2.	1-7

• Special categories of cited documents: <sup>10</sup>

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- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

**IV. CERTIFICATION**

Date of the Actual Completion of the International Search

09 June 1989

Date of Mailing of this International Search Report

17 JUL 1989

International Searching Authority

Signature of Authorized Officer

William Lewis

ISA/US

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